Nabil Fayoumi
10/15/2003 07:45 AM

To: gwvand cc: Thomas Martin, Kenneth Bardo, Sandra.Bron, KTorrent, wweir
Subject: DNAPL Investigation for Sauget Area 1

Gary,

Attached are the U.S. EPA's comments for the Work Plan for DNAPL Characterization and Remediation Study, Sauget Area 1, Sauget, Illinois, dated August 14, 2003.

The Objectives of the DNAPL Study is to collect data necessary to accomplish the objectives of the RIFS/EECA Report for Sauget Area 1 and to address all focus areas and the information requested in the January 9, 2003, U.S. EPA Additional Work Letter to Solutia. As discussed with Solutia, it is inappropriate for the DNAPL work plan to focus on the high costs and possible impracticability of treating large volumes of DNAPL-contaiminated fill and aquifer material and to present a technical Impracticability (TI) waiver as nearly foregone conclusion prior to data collection and evaluation. Such inappropriate language and conclusions should be removed from the work plan.

Please submit your responses to the attached comments within 21 days of receipt of this e-mail. If you have any questions, please contact me at 312-886-6840.


030820-RevisedDNAPLPlanComments


ada.sauget9.92903.wp

Sincerely,

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U. S. EPA - Region 5
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Comments on Revised Work Plan for DNAPL Characterization and Remediation Study, Solutia, Inc., Sauget Area 1, Sauget, Illinois dated August 14, 2003.

Comments prepared by Laramide Environmental, LLC August 20, 2003.

1. We appreciate the substantial revisions that have been made in this draft of the work plan. The revised work plan addresses the major focus areas presented in the January 9, 2003 letter from the United States Environmental Protection Agency (USEPA) to Solutia requesting the DNAPL characterization study.

2. *Section 2.0, Conceptual Site Model:* The focus of this section on the high costs and possible impracticability of treating large volumes of DNAPL-contaminated fill and aquifer material is inappropriate for a work plan that is designed to address precisely these questions. This section of the work plan presents a Technical Impracticability (TI) waiver as nearly a foregone conclusion prior to any data collection or evaluation. While a TI waiver is one possible response to DNAPL contamination in Sauget Area 1, other responses are also possible and should not be dismissed so readily in the planning stages of this investigation. The DNAPL characterization study should be conducted in an unbiased, objective manner to develop the scientific and engineering data required to make a defensible evaluation of response actions. The Conceptual Site Model section of the work plan should reflect an objective evaluation of existing data without focusing on one particular response action.

3. *Section 3.0 Task 4: Soil Sampling and Installation of Piezometers:* The inclusion of a minimum of 3 and potentially up to 15 locations for soil sampling and piezometer installation represents a substantial increase in the ability of the proposed work to address questions regarding the lateral and vertical extent of DNAPL contamination at Sauget Area 1. A significant concern of USEPA is the potential extent of DNAPL contamination outside the boundaries of the fill areas. For example, Figures 2 and 3 of the revised work plan both indicate a potential for DNAPL to be present downgradient of Site I, possibly as far as Route 3. Figure 2 is based on Table 4-0c prepared on the basis of field notes which Solutia has suggested in previous conversations are not reliable, although no description of the deficiencies in these observations has been provided. Figure 3 was prepared by the PRP's consultants and represents their interpretation of the potential DNAPL extent based on a general "1% of solubility" rule of thumb.

   The proposed work should include an evaluation of the extent of potential DNAPL contamination outside the fill areas in Sauget Area 1. No more than 3 additional borings beyond those proposed in the revised work plan should be required to adequately evaluate the extent of DNAPL contamination outside the fill areas. This would increase the total number of new borings and piezometers from 15 to a maximum of 18, with a likely minimum of 6. It is possible that one or more of the 12 borings planned for the fill areas could be relocated locations outside the fill area depending on the outcome of the Task 2 DNAPL and LNAPL survey, which would reduce the total number of borings accordingly. The additional information is necessary to evaluate the possible volume of material requiring treatment and to assess the residual conditions that would exist should a TI waiver be the selected

approach.

September 29, 2003

MEMORANDUM

SUBJECT: Sauget Area 1 Superfund Site, Sauget, IL (02-R05-001)
Workplan for DNAPL Characterization and Remediation Study

FROM: Steven D. Acree, Hydrogeologist
Applied Research and Technical Support Branch

TO: Nabil Fayoumi, RPM
U.S. EPA, Region 5

As requested, assumptions concerning the relationship between changes in aqueous-phase contaminant concentrations and DNAPL mass used in the referenced document have been reviewed by Dr. Daniel Pope of Dynamac Corporation. Dynamac Corporation is an off-site contractor providing technical support services to this laboratory. The concept that "changes in COC concentrations in groundwater are directly proportional to changes in DNAPL mass in the aquifer matrix" is stated several times in the workplan. This generalization is used, along with several other generalizations (*e.g.*, the assumption of uniform source concentrations across the source zone) to develop a conceptual model for facilitating estimates of contaminant removal rates and timeframes for remediation. The following comments regarding this assumption are provided for your consideration.

It is clear from theoretical models and laboratory and field research that dissolved contaminant concentrations in ground water are not *necessarily* directly proportional to the NAPL mass in the subsurface media. For instance, dissolved contaminant concentrations in ground water may reach an upper limit (based on maximum water solubility of the pure phase contaminant, or, for mixed NAPLs, based on the mole fraction of the given contaminant in the NAPL and water solubility), and, therefore, increased amounts of NAPL would not increase the dissolved concentration of the contaminant proportionally at equilibrium. Also, decreased amounts of NAPL may be associated with increased dissolved contaminant concentrations under certain conditions (*e.g.*, as the NAPL/ground-water interfacial area changes with time during dissolution of the NAPL under dynamic conditions).[1] In addition, ground water could be very near NAPL, but not in direct contact or communication with the NAPL, and possibly have no dissolved contaminants derived from the NAPL.

However, it appears that the conceptual model proposed in the *Workplan* and *Study* would at least provisionally justify use of the concept that "changes in COC concentrations in

groundwater are directly proportional to changes in DNAPLs mass in the aquifer matrix," based on the following considerations. The proposed conceptual model appears to be based on the concept of a "box" of subsurface material, where DNAPL may be found in pools and at residual saturation in blobs and ganglia. The DNAPL is being dissolved and removed in ground water as the ground water flows through and out of the "box." In the conceptual model, the contaminant concentration in ground water moving out of the "box" is assumed to be that of the "source concentration" *(i.e.*, the average dissolved contaminant concentration in a vertical plane, transverse to ground-water flow, just downgradient of the DNAPL source material). The "source concentration" plane idea is derived from the approach used in the Domenico solution to model contaminant transport and fate. The user's manual for the BIOSCREEN software provides a simple explanation of this idea.[2] While the dissolved contaminant concentration over time at any one point on the plane may not be directly proportional to changes in the upgradient NAPL mass (*e.g.*, the contaminant concentration at a given point might remain at the maximum solubility for an extended time), it may be reasonable to assume for estimation purposes that the average concentration across the entire plane may vary proportionally to the upgradient NAPL mass in the entire "box."

In addition, the averaging effects due to diffusion, dilution, dispersion and sampling with long well screens may tend to align the measured dissolved contaminant concentration with remaining NAPL mass in the "box" more than would be noted for the dissolved concentration that could be found in one small, defined flowpath. Also, the approach has some similarities to the approach used in the calculation of "Concentration vs. Time Attenuation Rate Constants," which have been used to estimate plume lifetimes at a given sampling location, and, therefore, indirectly to estimate the source lifetime (*i.e.*, a dissolved concentration is used to estimate source properties).[3] Nevertheless, the assumption as stated ("changes in COC concentrations in groundwater are directly proportional to changes in DNAPLs mass in the aquifer matrix") is subject to significant possibility of error, and should be used with caution.

This evaluation is limited to an assessment of the plausibility of the indicated part of the conceptual model (*i.e.*, "changes in COC concentrations in groundwater are directly proportional to changes in DNAPL mass in the aquifer matrix."), and is not intended to review any potential effects on remedy evaluation. Because the remediation comparisons and recommendations set forth in the *Workplan* and *Study* are based on calculations of the time necessary for dissolution to remove NAPL mass, and the proportionality assumption may strongly affect the results of such calculations, it is recommended that the workplan or final report fully discuss and evaluate the reasons for using the assumption, and provide alternative approaches to estimating NAPL removal for comparison.

If you have any questions concerning this evaluation, please do not hesitate to call me at your convenience (580-436-8609). We look forward to future interactions with you concerning this and other sites.

References

1) Wiedemeier, T.H., et al. *Natural Attenuation of Fuels and Chlorinated Solvents In The Subsurface.* 1999. John Wiley & Sons, NY. "Attenuation of Source Zones and Formation of Plumes." Page 97.

2) BIOSCREEN Natural Attenuation Decision Support System User's Manual. Version 1.3. June 1996. United States Environmental Protection Agency, Office of Research and Development. Washington DC 20460. EPA/600/R-96/087. August 1996.

3) Newell, C.J. et al. Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies. November 2002. Ground Water Issue. EPA 540/S-02/500.

cc: Rich Steimle (5102G)
Larry Zaragoza (5204G)
Luanne Vanderpool, Region 5
Doug Yeskis, Region 5